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GM-TARDEC Autonomous Safety Collaboration Meeting

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Background

Army “market” is different from automotive

- Quantities much smaller : hundreds, thousands, tens of thousands of vehicles
- Unit cost is much less important
- Maintenance and “sustainment” costs are important
- Supplier relations are more regulated and much more difficult
- Unique requirements
  - Shipping by C130
  - Air drop
- Many add-on systems in the field, little configuration mgt of vehicles
- Vehicles are very old technology, by automotive stds: very little electronic vehicle controls (bowden cable accel pedal)

Autonomous Safety Focus Areas

- **Safe operations in Urban Environments**
  - Detect & classify people & objects
  - Collision avoidance & route planning
  - Understanding of environments
  - Decision processing / Expected & rational behaviors in new scenarios
- **Collaboration between humans and robots**
  - Conduct collaborative missions with mixed manned/unmanned force
  - Collaborative air-ground operations

Technical Approach

Safety Design, Assessment, and Certification process for High Speed Autonomous Systems

- Develop robust, reliable, safety-critical architectures and designs. Deterministic subsystems provide safety "back-up" to overall system (e.g. Brakes, Steering, ETC, etc.).
- Leverage existing Safety System Development and Certification methods where possible. (E.g. MIL STD 882C, ISO 26262, etc)
- Propose new assessment methods for non-deterministic autonomous behaviors (e.g. "Least Bad" Decision-making on Path Planning, Object Avoidance, etc.)
- Testing methodology to certify autonomous systems "safe for Soldier use" needs to be developed.

Safety Critical Systems Issues

Issues:

- **Measurement and definition of safety considerations**
  - Need to develop methods to perform standardized Safety Assessment and Certification for Autonomous Systems
- **Mix of analog, digital, and mechanical controls on vehicles**
- **Different vehicle configurations in the field – many unknowns**
- **Interaction of vehicle safety and survivability**
- **Interaction with Army Safety organizations**

Example: Convoy Active Safety Technologies (CAST)

- Provide low cost Robotic Convoy capability for current force Army vehicles
- Provide lessons learned on robotic convoy for FCS(BCT)
- Leverage Robotic Follower ATO and other FCS Technologies
- Provide Robotics capability in CS/CSS community in out-years
- Generate Warfighter requirement for Robotic Convoy
- Drive-by-Wire design for Multi-follower TWV's
- Lessons learned for capabilities of low-cost convoy
- Turnkey operation of Robotic Convoy capability
- Leader-Follower with low dependency on GPS.
- Standard metrics for performance of robotic convoy capability

Warfighter Payoff:

- Decreased workload on driver
- Increased force protection / Battle Space awareness
- Increased Situational awareness
- Mission planning
- Route Recon
- Decreased fatigue effects

Autonomous System Block Diagram (Example)

Basic Vehicle Controls must meet Safety Critical requirements independent of the complete system, and the complete system composed of these subsystems must meet these requirements, also.